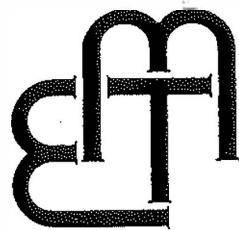


Final Report #2 Kiln

11/20/96



EMT Report Number 96-352  
Lime Kiln Compliance Test Program for  
Rockwell Lime Company  
Manitowoc, Wisconsin  
December 13, 1996

December 13, 1996

Mr. Don Brisch  
Rockwell Lime Company  
4110 Rockwood Road  
Manitowoc, WI 54220

Re: EMT Report Number 96-352  
Compliance Emissions Test Program  
Lime Kiln Exhaust

Dear Mr. Brisch:

Enclosed are three copies of Environmental Monitoring and Technologies Report No. 96-352, detailing the procedures followed, and results obtained, from the emissions compliance test program performed at your Manitowoc, Wisconsin facility.

If you have any questions or require additional information regarding this report, feel free to call me at 847/967-6666.

Sincerely,



Jay Whitaker  
Source Emissions Director

JW/tms

Copy: Keith Gray, EMT

EMT Report 96-352

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Appendix A

- Calculation Summary Sheets
- Field Data Sheets
- Monitor Data

Appendix B

- Laboratory Results
- Chain of Custody Records

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- Calibration Data

## OBJECTIVE

Rockwell Lime Company, of Manitowoc, Wisconsin, retained Environmental Monitoring and Technologies, Inc., to conduct a compliance test program upon one Lime Kiln Exhaust, at the Rockwell facility in Manitowoc, Wisconsin.

The intent of this test program was to demonstrate compliance with Wisconsin DNR Permit No. 93-RV-108, dated February 7, 1995.

Testing was performed as per the guidelines of the Wisconsin Department of Natural Resources (WDNR) and the United States Environmental Protection Agency (USEPA).

Parameters determined were:

- \* Stack gas velocity - ft. Per second
- \* Volumetric flow rate - acfm, dscfm, dscfh
- \* Oxygen and carbon dioxide content of stack gas - %
- \* Gas moisture content - % by volume
- \* Gas temperature - °F
- \* Particulate matter - gr/dscf, lb/hr
- \* Condensable particulate (back-halff) - gr/dscf, lb/hr
- \* Opacity - by CEM

Coordinating the sampling program were:

Don Brisch.....Rockwell Lime Company  
Jay Whitaker.....EMT Source Emissions Director  
Joe Wojcik.....EMT Project Manager

Mr. James Crawford, of the Wisconsin Department of Natural Resources, Green Bay Area Office, was also present to observe the testing.

## INTRODUCTION

### Overview of Project

Rockwell Lime Company is located at 4110 Rockwood Road, in Manitowoc, Wisconsin.

Three (3) one-hour runs were performed on November 20, 1996, at the Lime Kiln Baghouse Exhaust, for particulate emissions, condensable particulate, and sulfur dioxide.

### Sampling Location

The sampling location complied with the requirements in 40 CFR, Part 60, Appendix A, Method 1, with the following exception:

"B" dimension of approximately 6.5 ft. = approx. 1.08 dia.

This deviation was deemed acceptable by Mr. Jim Crawford, of the Wisconsin DNR.

The test ports were located beyond all existing pollution control devices.

The sampling location at the Lime Kiln Exhaust has a stack area of 27.494 ft.

## EMT Report 96-352

### SUMMARY OF SAMPLING

EMT performed the following USEPA procedures to meet the requirements of their specified work. These methods may be referenced in Title 40, Code of Federal Regulations, Part 60, Appendix A, Part 51, Appendix M, and the applicable ASTM documents. The methods are titled as follows:

- |                |   |
|----------------|---|
| EPA Method 1   | Sample and Velocity Traverses for Stationary Sources  |
| EPA Method 2   | Determination of Stack Gas Velocity and Volumetric Flow Rate<br>(Type S Pitot Tube)   |
| EPA Method 3   | Gas Analysis for the Determination of Dry Molecular Weight  |
| EPA Method 4   | Determination of Moisture Content in Stack Gas  |
| EPA Method 5   | Determination of Particulate Emissions from Stationary Sources<br>(WI modified method)  |
| EPA Method 6C  | Determination of Sulfur Dioxide Emissions from Stationary<br>Sources (Instrument Analyzer Procedure)                                |
| EPA Method 19  | Determination of Sulfur Dioxide Removal Efficiency and<br>Particulate Matter, Sulfur Dioxide, and Nitrogen Oxides<br>Emission Rates |
| EPA Method 202 | Determination of Condensable Particulate Emissions  |

EMT also adhered to the following EPA and ASTM procedures:

- |                   |   |
|-------------------|---|
| EPA 600/9-76-005  | Quality Assurance Handbook for Air Pollution<br>Measurement Systems, Vol. 1, Principles, 1976 |
| EPA 600/4-77-027b | Quality Assurance Handbook for Air Pollution<br>Measurement Systems, Vol. III, 1979           |
| ASTM E 300-92     | Standard Practice for Sampling Industrial Chemicals,<br>1992                                  |

### Determination of Volumetric Flow Rate

At the Lime Kiln Baghouse Exhaust, EMT sampled in accordance with EPA Methods 1-4

1. Teflon Tape was used on all joints to seal sample train.  
As part of each test run, the following was acquired:
  - a. a multi-point integrated gas sample was collected in order to determine the carbon dioxide content using Orsat gas analysis.
  - b. the gas flow was determined.
  - c. a point-by-point temperature grid was established.
  - d. the stack gas moisture was determined.
  - e. the static pressure was determined.

### Determination of Particulate Matter (including Condensable Particulate Matter)

Each test run for Particulate Matter was performed in accordance with EPA Method 5, as well as adhering to WDNR requirements:

1. Teflon Tape was used on all joints to seal the sampling train.
2. Sampling was performed isokinetically.
3. Glass microfibre filters were used to collect particulate matter.
4. Particulate grain loading was determined.
5. "Back-half" condensable particulate matter was determined in accordance with EPA Method 202.
6. Each test run was a minimum of 60 minutes in duration, with a minimum sample volume of 31.8 dscf. Three test runs were performed.
7. Results are reported in gr/dscf and lb/hr.

### Determination of Sulfur Dioxide

Each test run for Sulfur Dioxide was performed in accordance with EPA Method 6C, as well as adhering to WDNR requirements:

1. An integrated gas sample was extracted and drawn through a Bovar/Western Research 721 SO<sub>2</sub> monitor.
2. The sample gas was drawn through a heated sample line to prevent condensation prior to the gas conditioner.
3. Protocol calibration gases were used to calibrate this instrument Before and after every run.
4. A datalogger was used to collect data.
5. Results are expressed as ppmv db, and lb/hr.
6. Heat input is determined from the hourly average recorded during testing. Natural gas consumption and coal consumption was continuously monitored during testing.
7. F-factor for the above fuels is determined from Title 40, Code of Federal Regulations, Appendix A, Park 60, Method 19, Table 19-1.

### Visual Determination of the Opacity of Emissions from Stationary Sources

As per conversation with Mr. James Crawford, of the Wisconsin Department of Natural Resources, Green Bay Office, on November 1, 1996, Opacity CEM data will be acceptable for the determination of visible emissions.

Strip chart to be submitted directly to the Wisconsin DRN, by Rockwell Lime Company, along with this report.

## QUALITY ASSURANCE AND QUALITY CONTROL PROCEDURES

### Quality Control Procedures

Quality Control Procedures for all aspects of field sampling; sample preservation, holding time, reagent quality, analytical method, analyst training and safety, instrument cleaning, calibration and safety are followed. These procedures are consistent with EPA Guidelines documented in "Quality Assurance Handbook for Air Pollution Measurement Systems;" Volume III, "Stationary Source Specific Methods." (EPA-600/4-77-027b).

All appropriate equipment is calibrated at EMT's laboratory prior to delivery to the job site.

### Chain of Custody

Documentation of the chain of custody of samples and data obtained during the test program is essential for insuring the validity of the test program results. These procedures are followed during sampling, sample and data transport, sample preparation and analysis, storage of data, as well as archived samples and reported results.

EMT follows the protocol listed in SW 846, Section 1.3 during field sampling and in-house laboratory analysis.

### EMT Calibration Procedures and Frequency Chart

Dry gas meter:	Acceptable if $Y_i = Y \pm 2\%$ Calibrated vs. Standard meter.
Thermometers:	Impinger thermometer accurate within $\pm 1^\circ\text{C}$ , dry gas meter thermometer within $\pm 3^\circ\text{C}$ over range, stack temperature sensor $\pm 1.5\%$ of absolute temperature.
Probe Heating System:	Capable of maintaining $248^\circ\text{F} \pm 25^\circ$ at a flow of 0.71 ft./min.
Barometer:	Accurate within $\pm 2.5 \text{ mm}(0.1\text{in}) \text{ Hg}$ of Hg in glass barometer. Calibrated vs. Hg in glass barometer.
Type S Pitot tube:	Calibrated initially in the lab. Before and after each test run visual inspection.
Stack gas temperature measurement system:	Acceptable if capable of measuring within $\pm 1.5\%$ of minimum stack temperature. Calibrated initially and after each field testing program.

## EMT Report 96-352

### SUMMARY OF RESULTS

Summaries of test results from the emissions compliance test program conducted at Rockwell Lime Company, on November 20, 1996, as well as process data furnished by Rockwell Lime Company, is presented in the tables on the following pages.

Appendix A contains all Calculations Summary pages and Field Data Sheets.

Appendix B contains Laboratory Results and Chain of Custody Forms.

Appendix C contains Calibration and Gas Certification Sheets.

**SUMMARY TABLE #1 - LIME KILN EXHAUST RESULTS**

**COMPANY** Rockwell Lime Company  
**LOCATION** Manitowoc, WI (Rockwood)  
**SOURCE** Lime Kiln Exhaust  
**TEST DATE** 11-20-96

TEST RUN	1	2	3	AVERAGE
<b>GAS PARAMETERS</b>				
Velocity (ft/sec)	30.1	30.3	29.1	29.8
Volume flow (acf m)	49700.4	50011.9	48070.9	49261.1
Volume flow (dscfm)	27804.7	27941.6	26624.5	27456.9
Volume flow (scfh, wb)	1790809.7	1794091.8	1720186.3	1768362.6
Volume flow (dscfh)	1668281.7	1676494.4	1597468.4	1647414.8
Temperature (deg. F)	421.1	425.0	427.2	424.4
Oxygen (%)	9.3	8.9	7.8	8.7
Carbon Dioxide (%)	25.0	24.0	23.5	24.2
Moisture (% by volume)	6.8	6.6	7.1	6.8
<b>PARTICULATE SAMPLE</b>				
Mass collected				
Front (mg)	7.0	8.9	10.1	8.7
CPM inorganic (mg)	44.9	10.1	10.7	21.9
CPM organic (mg)	9.4	2.5	4.4	5.4
Particle concentration				
Total (gr/dscf)	0.0214	0.0074	0.0099	0.0129
Front (gr/dscf)	0.0024	0.0031	0.0040	0.0032
CPM inorganic (gr/dscf)	0.0157	0.0035	0.0042	0.0078
CPM organic (gr/dscf)	0.0033	0.0009	0.0017	0.0020
Emission Rate				
Ib/Ton Stone Feed	0.20	0.07	0.09	0.12
Total (lb/hr)	5.10	1.77	2.26	3.04
Front (lb/hr)	0.58	0.73	0.91	0.74
CPM inorganic (lb/hr)	3.73	0.83	0.96	1.84
CPM organic (lb/hr)	0.78	0.21	0.40	0.46
% Isokinetic	98.8	99.9	91.5	
<b>SO2 RESULTS</b>				
SO2 conc (ppm)	0.00	0.22	0.00	0.07
Emission rate (lb/hr)	0.00	0.06	0.00	0.02
Emission rate (lb/MMBTU)	0.000	0.001	0.000	0.00
<b>PROCESS DATA</b>				
Heat Input (MMBtu/hr)	88.96	89.63	91.30	
Stone Feed (Tons/hr)	25.99	25.03	25.29	

**OPACITY RESULTS**

The Opacity CEM read "0" throughout the entire test period.

Strip chart attached to this report by Rockwell Lime Company, prior to submittal to WDNR.

## Environmental Monitoring &amp; Technologies, Inc.

## SUMMARY TABLE #2 - PROCESS DATA / SUPPLEMENTARY RESULTS

Company: Rockwell Lime

Location: Manitowoc, WI

Source: Lime Kiln Exhaust

Run #: 1-3

Date: 11-20-96

## Manufacturing Data Compiled During EMT's Stack Test on #2 Kiln

Test Run	Time	Natural Gas	Coal/Coke Blend	Stone Feed	Baghouse Pressure Differential Readings Across Each Compartment								
		(CF)	(Lbs)	(Tons)	#1	#2	#3	#4	#5	#6	#7	#8	
#1	9:00 am - 10:00 am	21,200	4,913	25.99	2.4	2.6	2.7	2.0	2.1	2.8	1.7	2.8	
#2	11:00 am - 12:00 pm	21,900	4,910	25.03		1.9	2.6	2.9	2.2	2.2	2.7	1.2	2.5
#3	1:00 pm - 2:00 pm	22,200	5,010	25.29		2.6	2.0	2.3	2.5	2.5	2.2	1.3	2.7

Fuel Data	Natural Gas	Coal/Coke Blend
Btu Value / CF or Lb	1,014	13,731
% Sulfur / CF or LB	2.90E-05	2.76

$$\text{Total Heat Input MMBTU/hr} = ((\text{Nat. Gas CF} \times \text{BTU Value}) + (\text{Coal/Coke Blend Lbs} \times \text{BTU Value})) \div 1e06$$

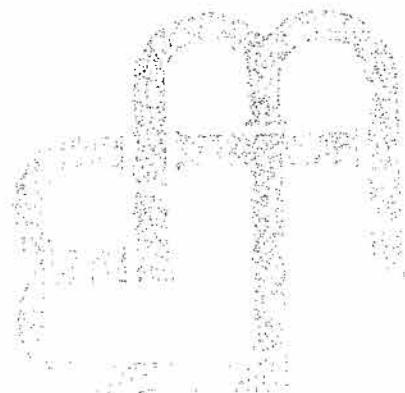
$$\text{SO}_2 \text{ lb/MMBTU} = \text{SO}_2 \text{ lb/hr} \div \text{MMBTU/hr}$$

$$\text{Particulate lb/Ton Stone Feed} = \text{Particulate lb/hr} \div \text{Ton Stone Feed/hr}$$

Test Run	Heat Input	SO <sub>2</sub>	SO <sub>2</sub>	Stone Feed	Particulates	Particulates
	(MMBTU/hr)	(lb/hr)	(lb/MMBTU)	(Tons/hr)	(lb/hr)	(lb/Ton Stone Feed)
#1	88.96	0.00	0.000	25.99	5.10	0.20
#2	89.63	0.06	0.001	25.03	1.77	0.07
#3	91.30	0.00	0.000	25.29	2.26	0.09

## Appendix A

**Calculation Summary Sheets  
Field Data Sheets  
Monitor Data**



# Environmental Monitoring & Technologies, Inc.

## EPA Methods 2-5 Moisture, Flow & Particulate Calculation Summary

Company Rockwell Lime  
 Location Manitowoc, WI (Rockwood)  
 Source Lime Kiln Exhaust  
 Run # 1  
 Date 11-20-96

Barometric (Pbar)	29.99 in.Hg	Static Pressure (Pg)	-0.08 in.H2O
Meter Y Factor (Y)	0.9984	Volume Measured (Vm)	42.920 cubic ft.
Stack Area (As)	27.494 sq. ft.	Square Root delta P	0.4336 in.H2O
Oxygen	9.3 %	Δ H	2.07 in.H2O
Carbon Dioxide	25.0 %	Gas Temperature (Ts)	421.1 °F
Impinger Condensate (Wi)	50 mL	Meter Temp. (Tm)	55.0 °F
Silica Gel Gain (Ws)	19 g	CPM Inorganic Mass (Mi)	44.9 mg
Front ½ Particulate (Mf)	7.0 mg	CPM Organic Mass (Mo)	9.4 mg
Run Time	60 minutes	Nozzle Diameter (Dn)	0.368 inches

### GAS SAMPLE VOLUME, DRY STANDARD CONDITIONS (Vmstd)

$$17.64 \times Vm \times Y \times (Pbar + \Delta H / 13.6) \times 1/Tm^{\circ}R = 44.242 \text{ dscf}$$

### VOLUME OF WATER IN GAS SAMPLE, STANDARD CONDITIONS (Vwstd)

$$(Wi \times 0.04707) + (Ws \times 0.04715) = 3.249 \text{ scf}$$

### PROPORTIONAL MOISTURE CONTENT OF GAS BY VOLUME (Bws)

$$\frac{Vwstd}{Vmstd + Vwstd} = 0.068 \\ = 6.8 \% \text{ by volume}$$

### GAS MOLECULAR WEIGHT, DRY BASIS (Md)

$$(0.44 \times CO_2\%) + (0.32 \times O_2\%) + (0.28 \times (100 - O_2\% - CO_2\%)) = 32.37 \text{ lb/lb-mole}$$

### GAS MOLECULAR WEIGHT, WET BASIS (Ms)

$$(Md \times (1-Bws)) + (18 \times Bws) = 31.39 \text{ lb/lb-mole}$$

### PITOT TUBE COEFFICIENT (Cp)

$$= 0.84$$

### ABSOLUTE GAS PRESSURE, (Ps)

$$Pbar + (\text{Static Pressure}/13.6) = 29.98 \text{ in. Hg}$$

### GAS VELOCITY, (Vs)

$$85.49 \times Cp \times \text{Square Root delta P} \times ((Ts^{\circ}R/(Ps \times Ms))^{\frac{1}{2}}) = 30.1 \text{ ft/sec.}$$

### GAS VOLUME FLOW RATE, (acf m)

$$\text{Stack Area} \times Vs \times 60 = 49700.4 \text{ acfm}$$

### GAS VOLUME FLOW RATE, (scfm)

$$\text{acf m} \times Tstd \times Ps / (Ts^{\circ}R \times Pstd) = 29846.8 \text{ scfm}$$

### GAS VOLUME FLOW RATE, (scfh)

$$\text{scfm} \times 60 = 1790809.7 \text{ scfh}$$

### GAS VOLUME FLOW RATE, (dscfm)

$$(1-Bws) \times \text{acf m} \times Tstd \times Ps / (Ts^{\circ}R \times Pstd) = 27804.7 \text{ dscfm}$$

### GAS VOLUME FLOW RATE, (dscfh)

$$\text{dscfm} \times 60 = 1668281.7 \text{ dscfh}$$

# Environmental Monitoring & Technologies, Inc.

## EPA Methods 2-5 Moisture, Flow & Particulate Calculation Summary

Company Rockwell Lime  
Location Manitowoc, WI (Rockwood)  
Source Lime Kiln Exhaust  
Run # 1  
Date 11-20-96

<u>GAS SAMPLE VOLUME, DRY STANDARD CONDITIONS (Vmstd)</u>	=	44.242 dscf
<u>PROPORTIONAL MOISTURE CONTENT OF GAS BY VOLUME (Bws)</u>	=	0.068
<u>GAS VOLUME FLOW RATE. (dscfh)</u>	=	1668281.7 dscfh
<u>FRONT ½ PARTICULATE MASS, FILTER AND PROBE WASH (Mf)</u>	=	7.0 mg
<u>CONDENSIBLE PARTICULATE MATTER (CPM), INORGANIC MASS (Mi)</u>	=	44.9 mg
<u>CONDENSIBLE PARTICULATE MATTER (CPM), ORGANIC MASS (Mo)</u>	=	9.4 mg
<u>FRONT ½ PARTICULATE CONCENTRATION. (gr/dscf)</u> $Mf \times 0.001g/mg \times 1/Vmstd \times 15.43 gr/g$	=	0.0024 gr/dscf
<u>INORGANIC CPM CONCENTRATION. (gr/dscf)</u> $Mi \times 0.001g/mg \times 1/Vmstd \times 15.43 gr/g$	=	0.0157 gr/dscf
<u>ORGANIC CPM CONCENTRATION. (gr/dscf)</u> $Mo \times 0.001g/mg \times 1/Vmstd \times 15.43 gr/g$	=	0.0033 gr/dscf
<u>TOTAL MEASURED PARTICULATE MATTER CONCENTRATION. (gr/dscf)</u>	=	0.0214 gr/dscf
<u>FRONT ½ PARTICULATE EMISSION RATE. (lb/hr)</u> $2.205E-06 lb/mg \times Mf \times dscfh \times 1/Vmstd$	=	0.5820 lb/hr
<u>INORGANIC CPM EMISSION RATE. (lb/hr)</u> $.205E-06 lb/mg \times Mi \times dscfh \times 1/Vmstd$	=	3.7333 lb/hr
<u>ORGANIC CPM EMISSION RATE. (lb/hr)</u> $2.205E-06 lb/mg \times Mo \times dscfh \times 1/Vmstd$	=	0.7816 lb/hr
<u>TOTAL MEASURED PARTICULATE EMISSION RATE. (lb/hr)</u>	=	5.0969 lb/hr
<u>CALCULATION OF PERCENT ISOKINETIC VARIATION</u>		
$100 \% \times (0.09450 \times Ts^{\circ}R \times Vmstd) / (Ps \times Vs \times An \times minutes \times (1-Bws))$	=	98.8 %
Gas Temperature, $Ts^{\circ}R = 881.1$	Gas Velocity, $Vs = 30.1$	
Absolute Gas Pressure, $Ps = 29.98$	$1 - Bws = 0.932$	
Area of Nozzle (sq.ft.), $An = 0.0007386$	minutes = 60	

CLIENT: Rockwell Lim 2  
 LOCATION: Rockwood, WI  
 SOURCE: Lime Kiln exhaust  
 DATE: 11-20-96  
 OPERATOR: Joe W  
 RUN #: 1  
 START: 9:00 STOP: 10:11  
 AMBIENT TEMPERATURE: 25°F  
 ASSUMED MOISTURE, %: 3.5%  
 PROBE HEATER SETTING: 250°F  
 HEATER BOX SETTING: ↓  
 PROJECT MANAGER: JW  
 METERBOX #: EMT 001  
 K FACTOR: 10.4335  
 BAROMETRIC PRESSURE: 29.99  
 Y FACTOR: .9984  
 METER ΔH@: 1.828  
 NOZZLE #, DIAM., in.: .363  
 STACK DIAMETER inches: 71  
 PORT LENGTH inches: 7.5  
 FILTER NUMBER: 5388  
 PRE-LEAK RATE: 0.09 CFM @ 5 in.Hg  
 POST-LEAK RATE: 0.10 CFM @ 7 in.Hg  
 PITOT LEAK CHECK: PRE: ✓ POST:  
 % OXYGEN: 9.3 % CO<sub>2</sub>: 5.5  
 LIQUID GAINED: 50 + GEL 19 = VLC:  
 C<sub>p</sub>: .84 STATIC PRESSURE + 0.08  
 AS = 27,4943898

11.077/11.187/(1,2)/10,219

CLOCK TIME	TRAVERSE POINT NUMBER	MIN/PT 2.5 SAMPLING	INITIAL VOLUME 376.12	VELOCITY HEAD .26	ORIFICE SETTING ΔH	PUMP VACUUM 6	STACK TEMPERATURE 423	GAS METER TEMPERATURE		IMPINGER OUTLET TEMPERATURE 44	FILTER BOX TEMPERATURE 250	PROBE TEMPERATURE 252
								Tin	Tout			
	A 1	2.5	378.31	.26	2.82	6	423	41	40	44	250	252
	2	5	380.39	.25	2.71	5	424	43	40	45	250	252
	3	7.5	382.11	.15	1.63	3	424	48	41	53	250	252
	4	10	384.14	.25	2.71	5	424	50	41	56	250	252
	5	12.5	386.10	.22	2.38	5	424	54	41	60	250	251
	6	15	387.93	.20	2.22	5	424	58	42	60	250	251
	7	17.5	389.76	.17	1.88	4	423	54	43	61	250	250
	8	20	391.31	.14	1.55	3	420	61	43	63	248	249
	9	22.5	393.44	.16	1.77	3	422	63	43	64	248	249
	10	25	394.61	.17	1.90	4	422	64	45	64	248	249
	11	27.5	396.14	.10	1.12	3	422	65	45	62	249	249
	12	30	397.73	.14	1.57	3	422	66	46	62	249	249
B 1	32.5	399.55	.19	2.24	4	415	58	47	48	250	251	
	2	35	401.66	.24	2.69	5	417	63	47	51	251	251
	3	37.5	403.92	.14	1.57	3	419	67	48	55	251	251
	4	40	405.01	.27	3.02	6	419	70	49	57	251	251
	5	42.5	406.90	.22	2.46	5	419	71	49	59	251	252
	6	45	408.70	.17	1.90	4	421	72	50	62	250	250
	7	47.5	412.19	.19	1.94	3	419	73	50	64	250	250
	8	50	413.21	.21	2.15	4	421	75	51	64	250	250
	9	52.5	413.70	.17	1.74	4	421	76	51	65	249	249
	10	55	415.53	.18	1.84	4	421	77	52	66	249	249
	11	57.5	417.46	.18	1.84	4	417	78	53	66	250	250
	12	60	419.04	.20	2.04	4	420	79	54	64	249	250

42.92

10 4058 49.69  
4221 7 07 1171 1 << 0

# Environmental Monitoring & Technologies, Inc.

## EPA Methods 2-5 Moisture, Flow & Particulate Calculation Summary

Company Rockwell Lime  
 Location Manitowoc, WI (Rockwood)  
 Source Lime Kiln Exhaust  
 Run # 2  
 Date 11-20-96

Barometric (Pbar)	29.99	in.Hg	Static Pressure (Pg)	-0.08	in.H2O
Meter Y Factor (Y)	0.9984		Volume Measured (Vm)	44.330	cubic ft.
Stack Area (As)	27.494	sq. ft.	Square Root delta P	0.4345	in.H2O
Oxygen	8.9	%	Δ H	2.01	in.H2O
Carbon Dioxide	24.0	%	Gas Temperature (Ts)	425.0	°F
Impinger Condensate (Wi)	56	mL	Meter Temp. (Tm)	63.2	°F
Silica Gel Gain (Ws)	11	g	CPM Inorganic Mass (Mi)	10.1	mg
Front ½ Particulate (Mf)	8.9	mg	CPM Organic Mass (Mo)	2.5	mg
Run Time	60	minutes	Nozzle Diameter (Dn)	0.368	inches

GAS SAMPLE VOLUME, DRY STANDARD CONDITIONS (Vmstd)

$$17.64 \times Vm \times Y \times (Pbar + \Delta H / 13.6) \times 1/Tm^{\circ}R = 44.972 \text{ dscf}$$

VOLUME OF WATER IN GAS SAMPLE, STANDARD CONDITIONS (Vwstd)

$$(Wi \times 0.04707) + (Ws \times 0.04715) = 3.155 \text{ scf}$$

PROPORTIONAL MOISTURE CONTENT OF GAS BY VOLUME (Bws)

$$\begin{aligned} Vwstd / (Vmstd + Vwstd) &= 0.066 \\ &= 6.6 \% \text{ by volume} \end{aligned}$$

GAS MOLECULAR WEIGHT, DRY BASIS (Md)

$$(0.44 \times CO_2\%) + (0.32 \times O_2\%) + (0.28 \times (100 - O_2\% - CO_2\%)) = 32.20 \text{ lb/lb-mole}$$

GAS MOLECULAR WEIGHT, WET BASIS (Ms)

$$(Md \times (1-Bws)) + (18 \times Bws) = 31.27 \text{ lb/lb-mole}$$

PITOT TUBE COEFFICIENT (Cp)

$$= 0.84$$

ABSOLUTE GAS PRESSURE, (Ps)

$$Pbar + (\text{Static Pressure}/13.6) = 29.98 \text{ in. Hg}$$

GAS VELOCITY (Vs)

$$85.49 \times Cp \times \text{Square Root delta P} \times ((Ts^{\circ}R/(Ps \times Ms))^{\frac{1}{2}}) = 30.3 \text{ ft/sec.}$$

GAS VOLUME FLOW RATE, (acf m)

$$\text{Stack Area} \times Vs \times 60 = 50011.9 \text{ acfm}$$

GAS VOLUME FLOW RATE, (scfm)

$$acf m \times Tstd \times Ps / (Ts^{\circ}R \times Pstd) = 29901.5 \text{ scfm}$$

GAS VOLUME FLOW RATE, (scfh)

$$scfm \times 60 = 1794091.8 \text{ scfh}$$

GAS VOLUME FLOW RATE, (dscfm)

$$(1-Bws) \times acfm \times Tstd \times Ps / (Ts^{\circ}R \times Pstd) = 27941.6 \text{ dscfm}$$

GAS VOLUME FLOW RATE, (dscfh)

$$dscfm \times 60 = 1676494.4 \text{ dscfh}$$

# Environmental Monitoring & Technologies, Inc.

## EPA Methods 2-5 Moisture, Flow & Particulate Calculation Summary

Company Rockwell Lime  
Location Manitowoc, WI (Rockwood)  
Source Lime Kiln Exhaust  
Run # 2  
Date 11-20-96

<u>GAS SAMPLE VOLUME, DRY STANDARD CONDITIONS (Vmstd)</u>	=	44.972 dscf
<u>PROPORTIONAL MOISTURE CONTENT OF GAS BY VOLUME (Bws)</u>	=	0.066
<u>GAS VOLUME FLOW RATE, (dscfh)</u>	=	1676494.4 dscfh
<u>FRONT 1/2 PARTICULATE MASS, FILTER AND PROBE WASH (Mf)</u>	=	8.9 mg
<u>CONDENSIBLE PARTICULATE MATTER (CPM), INORGANIC MASS (Mi)</u>	=	10.1 mg
<u>CONDENSIBLE PARTICULATE MATTER (CPM), ORGANIC MASS (Mo)</u>	=	2.5 mg
<u>FRONT 1/2 PARTICULATE CONCENTRATION, (gr/dscf)</u> $Mf \times 0.001\text{g/mg} \times 1/Vmstd \times 15.43 \text{ gr/g}$	=	0.0031 gr/dscf
<u>INORGANIC CPM CONCENTRATION, (gr/dscf)</u> $Mi \times 0.001\text{g/mg} \times 1/Vmstd \times 15.43 \text{ gr/g}$	=	0.0035 gr/dscf
<u>ORGANIC CPM CONCENTRATION, (gr/dscf)</u> $Mo \times 0.001\text{g/mg} \times 1/Vmstd \times 15.43 \text{ gr/g}$	=	0.0009 gr/dscf
<u>TOTAL MEASURED PARTICULATE MATTER CONCENTRATION, (gr/dscf)</u>	=	0.0074 gr/dscf
<u>FRONT 1/2 PARTICULATE EMISSION RATE, (lb/hr)</u> $2.205E-06 \text{ lb/mg} \times Mf \times dscfh \times 1/Vmstd$	=	0.7316 lb/hr
<u>INORGANIC CPM EMISSION RATE, (lb/hr)</u> $.205E-06 \text{ lb/mg} \times Mi \times dscfh \times 1/Vmstd$	=	0.8302 lb/hr
<u>ORGANIC CPM EMISSION RATE, (lb/hr)</u> $2.205E-06 \text{ lb/mg} \times Mo \times dscfh \times 1/Vmstd$	=	0.2055 lb/hr
<u>TOTAL MEASURED PARTICULATE EMISSION RATE, (lb/hr)</u>	=	1.7673 lb/hr
<u>CALCULATION OF PERCENT ISOKINETIC VARIATION</u>		
$100 \% \times (0.09450 \times Ts^\circ R \times Vmstd) / (Ps \times Vs \times An \times \text{minutes} \times (1-Bws))$	=	99.9 %
Gas Temperature, $Ts^\circ R = 885.0$	Gas Velocity, $Vs = 30.3$	
Absolute Gas Pressure, $Ps = 29.98$	$1 - Bws = 0.934$	
Area of Nozzle (sq.ft.), $An = 0.0007386$	minutes = 60	

CLIENT: K-Crete Lime  
 LOCATION: Rockwood WI  
 SOURCE: Lime Kiln exhaust  
 DATE: 11-20-96  
 OPERATOR: Joe W  
 RUN #: 2  
 START: 11:00 STOP: 12:08  
 AMBIENT TEMPERATURE: 29.99  
 ASSUMED MOISTURE, %: 99.84  
 PROBE HEATER SETTING: 250 F METER ΔH@: 1.828  
 HEATER BOX SETTING: ↓ PROBE NUMBER: PR 84 A  
 PROJECT MANAGER: Joe W NOZZLE # DIAM. in.: .368  
 METERBOX #: EMT 101 STACK DIAMETER inches: .71"  
 K FACTOR: 10.5 PORT LENGTH, inches: .75"  
 FILTER NUMBER 507  
 PRE-LEAK RATE: 6.7 CFM @ 5 in.Hg  
 POST-LEAK RATE: 0.11 CFM @ 10 in.Hg  
 PITOT LEAK CHECK: PRE: - POST: -  
 % OXYGEN: 8.9 % CO<sub>2</sub>: 24,  
 LIQUID GAINED: 56 + GEL 11 = Vc:  
 C<sub>p</sub>: STATIC PRESSURE + (-) 0.08  
 .84

CLOCK TIME	TRAVERSE POINT NUMBER	MIN/PT SAMPLING	INITIAL VOLUME SAMPLE VOLUME	VELOCITY HEAD ΔP	ORIFICE SETTING ΔH	PUMP VACUUM	STACK TEMPERATURE Ts	GAS METER TEMPERATURE		IMPIINGER OUTLET TEMPERATURE	FILTER BOX TEMPERATURE	PROBE TEMPERATURE
								Tin	Tout			
A 1	2.5	421.28	.27	2.34	6	422	51	50	46	250	254	
2	5	423.26	.24	2.52	5	424	54	51	49	250	250	
3	7.5	425.30	.23	2.62	5	424	58	51	48	251	249	
4	10	427.25	.15	1.58	4	425	63	50	47	250	250	
5	12.5	429.00	.19	2.0	5	425	64	50	48	249	248	
6	15	430.71	.16	1.68	4	425	66	50	49	250	252	
7	17.5	432.78	.27	2.84	6	421	68	51	49	250	248	
8	20	434.25	.15	1.58	4	423	70	51	50	250	250	
9	22.5	435.96	.16	1.68	4	424	72	52	50	251	252	
10	25	437.52	.12	1.26	3	422	72	52	49	250	253	
11	27.5	439.11	.13	1.36	3	425	73	52	48	250	251	
12	30	440.47	.13	1.36	3	422	74	53	48	250	248	
B 1	32.5	441.93	.14	1.47	6	421	68	54	46	249	245	
2	35	444.01	.21	2.2	6	423	73	54	47	249	253	
3	37.5	446.63	.22	2.31	5	425	73	55	49	250	249	
4	40	448.23	.21	2.2	5	427	76	55	49	250	248	
5	42.5	449.73	.24	2.52	5	428	77	55	51	250	247	
6	45	451.83	.26	2.73	6	427	80	56	53	250	249	
7	47.5	453.62	.18	1.89	5	427	83	57	55	250	250	
8	50	455.42	.18	1.89	5	427	83	57	55	250	250	
9	52.5	457.39	.22	2.31	5	428	84	59	59	250	248	
10	55	458.75	.14	1.47	4	430	85	59	59	250	253	
11	57.5	461.44	.22	2.31	6	428	87	59	61	249	248	
12	60	463.54	.16	1.68	4	428	87	61	62	249	248	

10.4274 48.3  
 44.33 4245 -.01  
 10201 3035  
 1175.0 13.2

# Environmental Monitoring & Technologies, Inc.

## EPA Methods 2-5 Moisture, Flow & Particulate Calculation Summary

Company Rockwell Lime  
 Location Manitowoc, WI (Rockwood)  
 Source Lime Kiln Exhaust  
 Run # 3  
 Date 11-20-96

Barometric (Pbar)	29.99 in.Hg	Static Pressure (Pg)	-0.08 in.H2O
Meter Y Factor (Y)	0.9984	Volume Measured (Vm)	38.840 cubic ft.
Stack Area (As)	27.494 sq. ft.	Square Root delta P	0.4158 in.H2O
Oxygen	7.8 %	Δ H	1.80 in.H2O
Carbon Dioxide	23.5 %	Gas Temperature (Ts)	427.2 °F
Impinger Condensate (Wi)	54 mL	Meter Temp. (Tm)	65.3 °F
Silica Gel Gain (Ws)	10 g	CPM Inorganic Mass (Mi)	10.7 mg
Front ½ Particulate (Mf)	10.1 mg	CPM Organic Mass (Mo)	4.4 mg
Run Time	60 minutes	Nozzle Diameter (Dn)	0.368 inches

### GAS SAMPLE VOLUME, DRY STANDARD CONDITIONS (Vmstd)

$$17.64 \times Vm \times Y \times (Pbar + \Delta H / 13.6) \times 1/Tm^{\circ}R = 39.225 \text{ dscf}$$

### VOLUME OF WATER IN GAS SAMPLE, STANDARD CONDITIONS (Vwstd)

$$(Wi \times 0.04707) + (Ws \times 0.04715) = 3.013 \text{ scf}$$

### PROPORTIONAL MOISTURE CONTENT OF GAS BY VOLUME (Bws)

$$Vwstd / (Vmstd + Vwstd) = 0.071 \\ = 7.1 \% \text{ by volume}$$

### GAS MOLECULAR WEIGHT, DRY BASIS (Md)

$$(0.44 \times CO_2\%) + (0.32 \times O_2\%) + (0.28 \times (100 - O_2\% - CO_2\%)) = 32.07 \text{ lb/lb-mole}$$

### GAS MOLECULAR WEIGHT, WET BASIS (Ms)

$$(Md \times (1-Bws)) + (18 \times Bws) = 31.07 \text{ lb/lb-mole}$$

### PITOT TUBE COEFFICIENT (Cp)

$$= 0.84$$

### ABSOLUTE GAS PRESSURE, (Ps)

$$Pbar + (\text{Static Pressure}/13.6) = 29.98 \text{ in. Hg}$$

### GAS VELOCITY, (Vs)

$$85.49 \times Cp \times \text{Square Root delta P} \times ((Ts^{\circ}R / (Ps \times Ms))^{\frac{1}{2}}) = 29.1 \text{ ft/sec.}$$

### GAS VOLUME FLOW RATE, (acf m)

$$\text{Stack Area} \times Vs \times 60 = 48070.9 \text{ acfm}$$

### GAS VOLUME FLOW RATE, (scfm)

$$\text{acf m} \times Tstd \times Ps / (Ts^{\circ}R \times Pstd) = 28669.8 \text{ scfm}$$

### GAS VOLUME FLOW RATE, (scfh)

$$scfm \times 60 = 1720186.3 \text{ scfh}$$

### GAS VOLUME FLOW RATE, (dscfm)

$$(1-Bws) \times acfm \times Tstd \times Ps / (Ts^{\circ}R \times Pstd) = 26624.5 \text{ dscfm}$$

### GAS VOLUME FLOW RATE, (dscfh)

$$dscfm \times 60 = 1597468.4 \text{ dscfh}$$

# Environmental Monitoring & Technologies, Inc.

## EPA Methods 2-5 Moisture, Flow & Particulate Calculation Summary

Company Rockwell Lime  
Location Manitowoc, WI (Rockwood)  
Source Lime Kiln Exhaust  
Run # 3  
Date 11-20-96

<u>GAS SAMPLE VOLUME, DRY STANDARD CONDITIONS (Vmstd)</u>	=	39.225 dscf
<u>PROPORTIONAL MOISTURE CONTENT OF GAS BY VOLUME (Bws)</u>	=	0.071
<u>GAS VOLUME FLOW RATE, (dscfh)</u>	=	1597468.4 dscfh
<u>FRONT 1/2 PARTICULATE MASS FILTER AND PROBE WASH (Mf)</u>	=	10.1 mg
<u>CONDENSIBLE PARTICULATE MATTER (CPM), INORGANIC MASS (Mi)</u>	=	10.7 mg
<u>CONDENSIBLE PARTICULATE MATTER (CPM), ORGANIC MASS (Mo)</u>	=	4.4 mg
<u>FRONT 1/2 PARTICULATE CONCENTRATION, (gr/dscf)</u> $Mf \times 0.001g/mg \times 1/Vmstd \times 15.43 gr/g$	=	0.0040 gr/dscf
<u>INORGANIC CPM CONCENTRATION, (gr/dscf)</u> $Mi \times 0.001g/mg \times 1/Vmstd \times 15.43 gr/g$	=	0.0042 gr/dscf
<u>ORGANIC CPM CONCENTRATION, (gr/dscf)</u> $Mo \times 0.001g/mg \times 1/Vmstd \times 15.43 gr/g$	=	0.0017 gr/dscf
<u>TOTAL MEASURED PARTICULATE MATTER CONCENTRATION, (gr/dscf)</u>	=	0.0099 gr/dscf
<u>FRONT 1/2 PARTICULATE EMISSION RATE, (lb/hr)</u> $2.205E-06 lb/mg \times Mf \times dscfh \times 1/Vmstd$	=	0.9070 lb/hr
<u>INORGANIC CPM EMISSION RATE, (lb/hr)</u> $.205E-06 lb/mg \times Mi \times dscfh \times 1/Vmstd$	=	0.9609 lb/hr
<u>ORGANIC CPM EMISSION RATE, (lb/hr)</u> $2.205E-06 lb/mg \times Mo \times dscfh \times 1/Vmstd$	=	0.3951 lb/hr
<u>TOTAL MEASURED PARTICULATE EMISSION RATE, (lb/hr)</u>	=	2.2630 lb/hr
<u>CALCULATION OF PERCENT ISOKINETIC VARIATION</u>		
$100 \% \times (0.09450 \times Ts^{\circ}R \times Vmstd) / (Ps \times Vs \times An \times \text{minutes} \times (1-Bws))$	=	91.5 %
Gas Temperature, $Ts^{\circ}R = 887.2$	Gas Velocity, $Vs = 29.1$	
Absolute Gas Pressure, $Ps = 29.98$	$1 - Bws = 0.929$	
Area of Nozzle (sq.ft.), $An = 0.0007386$	minutes = 60	

CLIENT: Rockwell Lime  
 LOCATION: Rockwood, WI  
 SOURCE: Lime Kiln Exhaust  
 DATE: 11/20/96  
 OPERATOR: KT  
 RUN #: 3  
 START: 10:01 STOP: 14:11  
 AMBIENT TEMPERATURE: 29.49  
 ASSUMED MOISTURE, %: 9.989  
 PROBE HEATER SETTING: 250  
 HEATER BOX SETTING: 250  
 PROJECT MANAGER: JW  
 METERBOX #: EM1 001  
 K FACTOR: 10.5/10.2  
 BAROMETRIC PRESSURE: 29.49  
 Y FACTOR: .9989  
 METER ΔH@: 1.828  
 PROBE NUMBER: PR 84 A  
 NOZZLE #, DIAM., in.: 3.68  
 STACK DIAMETER inches: 71"  
 PORT LENGTH, inches: 7.5"  
 FILTER NUMBER: 5274  
 PRE-LEAK RATE: 010 CFM @ 1" in.Hg  
 POST-LEAK RATE: 0.01 CFM @ 7" in.Hg  
 PITOT LEAK CHECK: PRE: ✓ POST: ✓  
 % OXYGEN: 7.8 % CO<sub>2</sub>: 23.5  
 LIQUID GAINED: 5.4 + GEL 10 = VAC  
 C<sub>p</sub>: 84 STATIC PRESSURE + 0.08

CLOCK TIME	TRaverse Point Number	Min/Pt Sampling	Initial Volume 463.64	Gas Meter Temperature		Impinger Outlet Temperature	Filter Box Temperature	Probe Temperature
				Veloc. Head ΔP	Orifice Setting ΔH			
	A1	2.5	465.39	.18	1.9	5	427	55 248 252
	2	5	467.31	.23	2.4	5.5	426	56 247 253
	3	7.5	469.00	.23	2.3	5.5	427	55 250 253
	4	10	470.57	.16	1.6	9	428	63 251 253
	5	12.5	472.16	.18	1.8	4.5	429	65 255 251
	6	15	473.61	.13	1.3	4	426	68 255 250
	7	17.5	475.08	.14	1.4	4	431	70 255 251
	8	20	476.55	.13	1.3	4	478	72 255 249
	9	22.5	477.86	.11	1.1	3.5	427	73 256 249
	10	25	479.20	.12	1.2	3.5	429	73 256 249
	11	27.5	480.46	.10	1.0	3.5	423	75 257 249
	12	30	481.40	.05	.51	3.0	420	75 249 249
B1	32.5	483.40	.27	2.8	6.0	426	64 250 256	
	2	35	484.99	.15	1.5	9.5	428	74 249 251
	3	37.5	486.53	.14	1.4	4.0	427	74 250 261
	4	40	488.23	.23	2.3	5	428	76 250 252
	5	42.5	490.05	.23	2.3	5	429	78 250 253
	6	45	491.75	.17	1.7	9.5	428	80 250 251
	7	47.5	493.67	.20	2.0	5	428	81 251 251
	8	50	495.48	.25	2.6	6.0	429	82 250 250
	9	52.5	497.02	.20	2.0	5	431	81 249 250
	10	55	498.98	.25	2.6	6	430	81 250 249
	11	57.5	500.78	.25	2.6	6	426	83 250 250
	12	6.0	502.49	.17	1.7	9.5	423	84 251 250

38.84

9.9802 43.31 10253 3135  
4158 1.80 1177.2 65.3

CLIENT: W.W. W. AMBIENT TEMPERATURE: 71.59  
 LOCATION: Marquette, WI ASSUMED MOISTURE, %: 0 Y FACTOR: 1.00  
 SOURCE: Lime Kiln exhaust PROBE HEATER SETTING: 100 METER ΔH@: 0  
 DATE: 11/20/96 HEATER BOX SETTING: 100 PROBE NUMBER: 0  
 OPERATOR:  PROJECT MANAGER:  NOZZLE #, DIAM., in.:   
 RUN #: 1 METERBOX #:  STACK DIAMETER inches: 71 "  
 START:  STOP:  K FACTOR:  PORT LENGTH, inches: 7.5 "  
 C<sub>p</sub>:  STATIC PRESSURE + 0.08  
 , 84

CLOCK TIME	TRAVERSE POINT NUMBER	MIN/PT SAMPLING	INITIAL VOLUME SAMPLE VOLUME	VELOCITY HEAD Δ P	ORIFICE SETTING Δ H	PUMP VACUUM	STACK TEMPERATURE Ts	GAS METER TEMPERATURE		IMPINGER OUTLET TEMPERATURE Tin	FILTER BOX TEMPERATURE Tout	PROBE TEMPERATURE
								Tin	Tout			
11.21	A1			.27	/		423					
11.22	2			.26			425					
11.23	3			.23			425					
11.24	4			.23			424					
11.25	5			.20			424					
11.26	6			.19			424					
11.27	7			.19			424					
11.28	8			.19			424					
11.29	9			.19			424					
11.30	10			.17			425					
11.31	11			.17			423					
11.32	12			.19			422					
11.33	B1			.23			423					
11.34	2			.22			423					
11.35	3			.23			425					
11.36	4			.23			425					
11.37	5			.24			427					
11.38	6			.25			428					
11.39	7			.23			428					
11.40	8			.24			427					
11.41	9			.24			427					
11.42	10			.21			425					
11.43	11			.19	10.949		423					
11.44	12			.13	4577		421	125.04				

15-22 L.E. = 364

FT/HL = 49.37



DATE	TIME	SO2 ppm	ROCKWELL LIME COMPANY
112096	7:00	-14.8	
112096	7:01	-14.8	<b>Calibration Data In Bold</b>
112096	7:02	-14.7	<u>Test Data Underlined</u>
112096	7:03	-14.6	
112096	7:04	-14.6	
112096	7:05	-14.6	
112096	7:06	-14.5	
112096	7:07	-14.6	
112096	7:08	-14.6	
112096	7:09	-14.5	
112096	7:10	-14.5	
112096	7:11	-14.6	
112096	7:12	-14.6	
112096	7:13	-12.8	
112096	7:14	-0.2	
112096	7:15	-0.1	
112096	7:16	-0.1	
112096	7:17	0.3	
112096	7:18	86.7	
112096	7:19	91.2	
112096	7:20	91.2	
112096	7:21	<b>91.1</b>	
112096	7:22	<b>91.1</b>	
112096	7:23	75.7	
112096	7:24	2.6	
112096	7:25	0.1	
112096	7:26	<b>0.2</b>	
112096	7:27	19.8	
112096	7:28	48.0	
112096	7:29	48.1	
112096	7:30	<b>48.1</b>	
112096	7:31	45.6	
112096	7:32	3.8	
112096	7:33	1.6	
112096	7:34	1.6	
112096	7:35	2.1	
112096	7:36	23.9	
112096	7:37	54.5	
112096	7:38	70.2	
112096	7:39	78.5	
112096	7:40	82.0	
112096	7:41	82.4	
112096	7:42	85.3	
112096	7:43	86.8	
112096	7:44	87.4	
112096	7:45	82.0	
112096	7:46	84.7	
112096	7:47	87.7	
112096	7:48	87.7	
112096	7:49	44.3	
112096	7:50	16.6	
112096	7:51	9.9	
112096	7:52	7.2	
112096	7:53	5.8	
112096	7:54	5.0	
112096	7:55	5.4	
112096	7:56	82.0	

DATE	TIME	SO2 ppm	ROCKWELL LIME COMPANY
112096	7:57	72.6	
112096	7:58	4.1	
112096	7:59	2.1	
112096	8:00	2.0	
112096	8:01	1.8	
112096	8:02	1.7	
112096	8:03	1.7	
112096	8:04	1.6	
112096	8:05	1.6	
112096	8:06	1.4	
112096	8:07	1.5	
112096	8:08	1.4	
112096	8:09	1.4	
112096	8:10	1.5	
112096	8:11	51.3	
112096	8:12	86.7	
112096	8:13	27.6	
112096	8:14	81.9	
112096	8:15	40.6	
112096	8:16	89.3	
112096	8:17	89.9	
112096	8:18	90.4	
112096	8:19	90.6	
112096	8:20	74.0	
112096	8:21	6.2	
112096	8:22	2.3	
112096	8:23	1.8	
112096	8:24	2.6	
112096	8:25	1.6	
112096	8:26	1.4	
112096	8:27	12.4	
112096	8:28	45.5	
112096	8:29	46.7	
112096	8:30	47.7	
112096	8:31	48.3	
112096	8:32	38.7	
112096	8:33	3.2	
112096	8:34	1.1	
112096	8:35	1.0	
112096	8:36	10.3	
112096	8:37	5.6	
112096	8:38	2.4	
112096	8:39	2.1	
112096	8:40	1.9	
112096	8:41	1.7	
112096	8:42	1.4	
112096	8:43	1.4	
112096	8:44	1.3	
112096	8:45	1.2	
112096	8:46	1.2	
112096	8:47	1.2	
112096	8:48	1.2	
112096	8:49	1.2	
112096	8:50	1.0	
112096	8:51	0.9	
112096	8:52	0.9	
112096	8:53	1.0	

DATE	TIME	SO2 ppm	ROCKWELL LIME COMPANY		
112096	8:54	1.0			
112096	8:55	0.9			
112096	8:56	0.9			
112096	8:57	0.9			
112096	8:58	0.6			
112096	8:59	0.5			
112096	9:00	0.5	START RUN		1
112096	9:01	<u>0.4</u>			
112096	9:02	<u>0.4</u>	AVERAGE CONCENTRATION		
112096	9:03	<u>0.4</u>			
112096	9:04	<u>0.4</u>	SO2	0.01	ppm
112096	9:05	<u>0.2</u>		%	
112096	9:06	<u>0.3</u>			
112096	9:07	<u>0.3</u>	AVERAGE CALIBRATION		
112096	9:08	<u>0.2</u>			
112096	9:09	<u>0.3</u>	ZERO	CAL.	
112096	9:10	<u>0.2</u>	SO2	0.98	47.22 ppm
112096	9:11	<u>0.1</u>			
112096	9:12	<u>0.2</u>			
112096	9:13	<u>0.2</u>			
112096	9:14	<u>0.1</u>	FINAL CALIBRATION CORRECTED TEST RESULTS		
112096	9:15	<u>0.1</u>			
112096	9:16	<u>0.1</u>	SO2	0.00	ppm *
112096	9:17	<u>-0.0</u>	SO2	0.00	lb/hr **
112096	9:18	<u>0.1</u>	FLOW	1668281.7	dscfh
112096	9:19	<u>-0.1</u>			
112096	9:20	<u>-0.0</u>			
112096	9:21	<u>0.0</u>			
112096	9:22	<u>-0.0</u>			
112096	9:23	<u>-0.1</u>			
112096	9:24	<u>-0.1</u>			
112096	9:25	<u>-0.1</u>			
112096	9:26	<u>-0.0</u>			
112096	9:27	<u>-0.1</u>			
112096	9:28	<u>-0.1</u>			
112096	9:29	<u>-0.3</u>			
112096	9:30	<u>-0.2</u>			
112096	9:31	<u>-0.1</u>			
112096	9:32	<u>-0.1</u>			
112096	9:33	<u>-0.1</u>			
112096	9:34	<u>-0.1</u>			
112096	9:35	<u>-0.2</u>			
112096	9:36	<u>-0.2</u>			
112096	9:37	<u>-0.2</u>			
112096	9:38	<u>-0.0</u>			
112096	9:39	<u>-0.0</u>			
112096	9:40	<u>-0.1</u>			
112096	9:41	<u>-0.1</u>			
112096	9:42	<u>-0.1</u>			
112096	9:43	<u>-0.2</u>			
112096	9:44	<u>-0.2</u>			
112096	9:45	<u>-0.2</u>			
112096	9:46	<u>-0.1</u>			
112096	9:47	<u>-0.1</u>			
112096	9:48	<u>-0.1</u>			
112096	9:49	<u>-0.1</u>			
112096	9:50	<u>-0.1</u>			

DATE	TIME	SO2 ppm	ROCKWELL LIME COMPANY
112096	9:51	<u>-0.1</u>	
112096	9:52	<u>-0.0</u>	
112096	9:53	<u>-0.0</u>	
112096	9:54	<u>-0.1</u>	
112096	9:55	<u>-0.0</u>	
112096	9:56	<u>0.0</u>	
112096	9:57	<u>-0.0</u>	
112096	9:58	<u>-0.0</u>	
112096	9:59	<u>-0.1</u>	
112096	10:00	<u>0.0</u>	END RUN 1
112096	10:01	1.5	* Corrected SO2 calculated as follows :
112096	10:02	34.5	(SO2 conc.-Avg. zero) x (Cal. gas conc.) / ( Avg. cal.-Avg. zero)
112096	10:03	46.1	SO2 cal gas = 47.8 ppm
112096	10:04	46.3	
112096	10:05	46.5	** SO2 lb/hr calculated as follows :
112096	10:06	47.3	(Flow,dscfh) x (Corrected SO2 ppm x 64.06) / (385.26E06)
112096	10:07	47.9	
112096	10:08	48.2	
112096	10:09	48.1	
112096	10:10	44.4	
112096	10:11	5.5	
112096	10:12	1.1	
112096	10:13	0.7	
112096	10:14	0.6	
112096	10:15	0.6	
112096	10:16	0.5	
112096	10:17	0.4	
112096	10:18	0.4	
112096	10:19	0.5	
112096	10:20	0.5	
112096	10:21	0.4	
112096	10:22	0.5	
112096	10:23	0.5	
112096	10:24	0.6	
112096	10:25	0.5	
112096	10:26	0.6	
112096	10:27	0.7	
112096	10:28	0.7	
112096	10:29	0.6	
112096	10:30	0.7	
112096	10:31	0.6	
112096	10:32	0.6	
112096	10:33	0.7	
112096	10:34	0.6	
112096	10:35	0.8	
112096	10:36	0.7	
112096	10:37	0.8	
112096	10:38	0.8	
112096	10:39	0.8	
112096	10:40	0.8	
112096	10:41	0.7	
112096	10:42	0.2	
112096	10:43	0.1	
112096	10:44	0.1	
112096	10:45	0.2	
112096	10:46	0.1	
112096	10:47	0.2	

DATE	TIME	SO2 ppm	ROCKWELL LIME COMPANY		
112096	10:48	0.3			
112096	10:49	0.2			
112096	10:50	0.3			
112096	10:51	0.3			
112096	10:52	0.2			
112096	10:53	0.3			
112096	10:54	0.3			
112096	10:55	0.5			
112096	10:56	0.4			
112096	10:57	0.5			
112096	10:58	0.4			
112096	10:59	0.4			
112096	11:00	0.4	<hr/> START RUN 2		
112096	11:01	0.5			
112096	11:02	0.4	AVERAGE CONCENTRATION		
112096	11:03	0.4			
112096	11:04	0.5	SO2	0.87	ppm
112096	11:05	0.5		%	
112096	11:06	0.5			
112096	11:07	0.6	AVERAGE CALIBRATION		
112096	11:08	0.6			
112096	11:09	0.6	ZERO	CAL.	
112096	11:10	0.6	SO2	0.66	48.29 ppm
112096	11:11	0.6			
112096	11:12	0.6			
112096	11:13	0.7			
112096	11:14	0.5	FINAL CALIBRATION CORRECTED TEST RESULTS		
112096	11:15	0.6			
112096	11:16	0.7	SO2	0.22	ppm
112096	11:17	0.6	SO2	0.06	lb/hr
112096	11:18	0.6	FLOW	1676494.4	dscfh
112096	11:19	0.7			
112096	11:20	0.7			
112096	11:21	0.7			
112096	11:22	0.7			
112096	11:23	0.8			
112096	11:24	0.8			
112096	11:25	0.9			
112096	11:26	0.8			
112096	11:27	0.8			
112096	11:28	0.9			
112096	11:29	0.8			
112096	11:30	0.8			
112096	11:31	0.8			
112096	11:32	0.9			
112096	11:33	0.9			
112096	11:34	0.9			
112096	11:35	0.8			
112096	11:36	1.0			
112096	11:37	1.0			
112096	11:38	0.9			
112096	11:39	1.0			
112096	11:40	1.0			
112096	11:41	1.0			
112096	11:42	1.1			
112096	11:43	1.1			
112096	11:44	1.0			

DATE TIME SO2 ppm ROCKWELL LIME COMPANY

112096	11:45	<u>1.2</u>	
112096	11:46	<u>1.1</u>	
112096	11:47	<u>1.1</u>	
112096	11:48	<u>1.2</u>	
112096	11:49	<u>1.1</u>	
112096	11:50	<u>1.1</u>	
112096	11:51	<u>1.2</u>	
112096	11:52	<u>1.1</u>	
112096	11:53	<u>1.3</u>	
112096	11:54	<u>1.3</u>	
112096	11:55	<u>1.3</u>	
112096	11:56	<u>1.3</u>	
112096	11:57	<u>1.2</u>	
112096	11:58	<u>1.4</u>	
112096	11:59	<u>1.4</u>	
112096	12:00	<u>1.4</u>	END RUN 2
112096	12:01	16.9	
112096	12:02	47.6	
112096	12:03	48.3	
112096	12:04	48.5	
112096	12:05	48.4	
112096	12:06	12.9	
112096	12:07	2.6	
112096	12:08	2.1	
112096	12:09	1.9	
112096	12:10	1.9	
112096	12:11	0.5	
112096	12:12	-0.1	
112096	12:13	-0.1	
112096	12:14	-0.1	
112096	12:15	-0.1	
112096	12:16	-0.0	
112096	12:17	-0.0	
112096	12:18	0.0	
112096	12:19	-0.0	
112096	12:20	0.0	
112096	12:21	0.1	
112096	12:22	0.1	
112096	12:23	-0.1	
112096	12:24	0.1	
112096	12:25	0.1	
112096	12:26	0.1	
112096	12:27	0.1	
112096	12:28	0.2	
112096	12:29	0.3	
112096	12:30	0.3	
112096	12:31	0.2	
112096	12:32	0.3	
112096	12:33	0.3	
112096	12:34	0.4	
112096	12:35	0.4	
112096	12:36	0.4	
112096	12:37	0.3	
112096	12:38	0.5	
112096	12:39	0.5	
112096	12:40	0.5	
112096	12:41	0.6	

DATE	TIME	SO2 ppm	ROCKWELL LIME COMPANY	
112096	12:42	0.6		
112096	12:43	0.8		
112096	12:44	0.8		
112096	12:45	0.8		
112096	12:46	0.7		
112096	12:47	-0.1		
112096	12:48	0.0		
112096	12:49	0.1		
112096	12:50	0.0		
112096	12:51	0.1		
112096	12:52	0.1		
112096	12:53	0.1		
112096	12:54	0.0		
112096	12:55	0.0		
112096	12:56	0.2		
112096	12:57	0.1		
112096	12:58	0.1		
112096	12:59	0.2		
112096	13:00	0.0	START RUN	3
112096	13:01	0.1		
112096	13:02	0.2	AVERAGE CONCENTRATION	
112096	13:03	0.1		
112096	13:04	0.1	SO2	0.52 ppm
112096	13:05	0.1		%
112096	13:06	0.1		
112096	13:07	0.2	AVERAGE CALIBRATION	
112096	13:08	0.1		
112096	13:09	0.2	ZERO	CAL.
112096	13:10	0.1	SO2	0.66 48.46 ppm
112096	13:11	0.2		
112096	13:12	0.2		
112096	13:13	0.2		
112096	13:14	0.2	FINAL CALIBRATION CORRECTED TEST RESULTS	
112096	13:15	0.3		
112096	13:16	0.3	SO2	0.00 ppm
112096	13:17	0.2	SO2	0.00 lb/hr
112096	13:18	0.2	FLOW	1597468.4 dscfh
112096	13:19	0.3		
112096	13:20	0.3		
112096	13:21	0.3		
112096	13:22	0.3		
112096	13:23	0.5		
112096	13:24	0.4		
112096	13:25	0.3		
112096	13:26	0.4		
112096	13:27	0.5		
112096	13:28	0.4		
112096	13:29	0.4		
112096	13:30	0.5		
112096	13:31	0.4		
112096	13:32	0.5		
112096	13:33	0.6		
112096	13:34	0.6		
112096	13:35	0.6		
112096	13:36	0.7		
112096	13:37	0.7		
112096	13:38	0.7		

DATE	TIME	SO2 ppm	ROCKWELL LIME COMPANY
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112096	13:39	<u>0.7</u>	
112096	13:40	<u>0.8</u>	
112096	13:41	<u>0.7</u>	
112096	13:42	<u>0.8</u>	
112096	13:43	<u>0.8</u>	
112096	13:44	<u>0.8</u>	
112096	13:45	<u>0.9</u>	
112096	13:46	<u>0.8</u>	
112096	13:47	<u>0.8</u>	
112096	13:48	<u>0.8</u>	
112096	13:49	<u>0.8</u>	
112096	13:50	<u>0.9</u>	
112096	13:51	<u>1.0</u>	
112096	13:52	<u>0.9</u>	
112096	13:53	<u>0.9</u>	
112096	13:54	<u>0.9</u>	
112096	13:55	<u>0.9</u>	
112096	13:56	<u>0.8</u>	
112096	13:57	<u>0.9</u>	
112096	13:58	<u>0.9</u>	
112096	13:59	<u>0.9</u>	
112096	14:00	<u>1.0</u>	END RUN
112096	14:01	21.3	3
112096	14:02	43.8	
112096	14:03	47.1	
112096	14:04	48.3	
112096	14:05	48.5	
112096	14:06	48.5	
112096	14:07	38.1	
112096	14:08	3.8	
112096	14:09	1.7	
112096	14:10	1.5	
112096	14:11	1.4	
112096	14:12	1.3	

Appendix B

Laboratory Results  
Chain of Custody Records



# ENVIRONMENTAL MONITORING AND TECHNOLOGIES, INC.

8100 North Austin Avenue  
Morton Grove, Illinois 60053-3203  
847-967-6666  
FAX: 847-967-6735

## LABORATORY REPORT

154159

Rockwell Lime  
4110 Rockwood Road  
Manitowoc, WI 54220

Report Date: 12/2/96  
Sample Received: 11/21/96

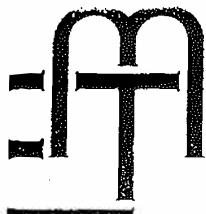
Location: Lime Kiln Exhaust  
Sample Description: Air

Date Sampled	Sample No.	Description	Results
11/21	70662	Filter 5288 - Run 1	0.0018 g
11/21	70663	Filter 5271 - Run 2	0.0023 g
11/21	70664	Filter 5274 - Run 3	0.0024 g
11/21	70665	Probe Wash - Run 1	0.0057 g
11/21	70666	Probe Wash - Run 2	0.0071 g
11/21	70667	Probe Wash - Run 3	0.0082 g
11/21	70668	Impinger - Run 1	0.0486 g
11/21	70669	Impinger - Run 2	0.0138 g
11/21	70670	Impinger - Run 3	0.0144 g
11/21	70671	MeCl <sub>2</sub> Rinse - Run 1	0.0126 g
11/21	70672	MeCl <sub>2</sub> Rinse - Run 2	0.0057 g
11/21	70673	MeCl <sub>2</sub> Rinse - Run 3	0.0076 g
11/21	70674	MeCl <sub>2</sub> Blank	0.0032 g
11/21	70675	Water Blank	0.0037 g
11/21	70676	Acetone Blank	0.0005 g
11/21	70677	Filter Blank	-0.0000 g

Analysis performed in accordance with 40 CFR Part 51 Appendix A Method 201A.

The contents of this report apply to the sample analyzed. No duplication of this report is allowed except its entirety.

*Larry W. Utley*



# **ENVIRONMENTAL MONITORING AND TECHNOLOGIES, INC.**

**8100 North Austin Avenue  
Morton Grove, Illinois 60053-3203**

TURNAROUND TIME:  
 RUSH      \_\_\_\_\_ day turnaround  
 ROUTINE

## Chain of Custody Record

**8100 North Austin Avenue  
Morton Grove, Illinois 60053-3203**

708-967-6666  
FAX: 708/967-6735

Due Date: \_\_\_\_\_ COC #: 31944

Company: Rockwell Lime

ddress: \_\_\_\_\_

Phone #: (\_\_\_\_) \_\_\_\_\_ - \_\_\_\_\_ Fax #: (\_\_\_\_) \_\_\_\_\_ - \_\_\_\_\_

O.#: \_\_\_\_\_ Proj.#: \_\_\_\_\_

Client Contact: Don Brisch

Project ID / Location: lime kiln exhaust

Sample ID      Sample      Container      Sampling

Sample I.D.	Sample	Container		Sampling			
Characters ONLY		Type	Size	Type	No.	Date	Time

Sample Type: Container Type:

- . Water P - Plastic
  - . Soil G - Glass
  - . Sludge V - VOC
  - . Oil B - Bag
  - . Tissue O - Other

#### **Preservative:**

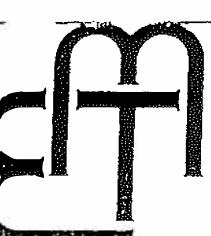
- . None    3. HNO<sub>3</sub>  
 2. H<sub>2</sub>SO<sub>4</sub>    4. NaOH

## Analyses

**EMT REQUIRES PRIOR NOTICE OF SAMPLES CONTAINING CYANIDE. EMT SAMPLE RETURN POLICY ON BACK.**

elinquished By: <i>Sol Wojciech</i>	Date: 11- 21 -96 Time: 10 : 56 AM	Received By:	Date: -- -- Time: :	Witness:	<input type="checkbox"/> SAMPLE RECEIVED ON ICE
elinquished By:	Date: -- Time: :	Received For Lab By: <i>[Signature]</i>	Date: 11- 21 96 Time: 2:49		<input checked="" type="checkbox"/> TEMPERATURE ( )

**SPECIAL INSTRUCTIONS:**



# ENVIRONMENTAL MONITORING AND TECHNOLOGIES, INC.

8100 North Austin Avenue  
Morton Grove, Illinois 60053-3203

**TURNAROUND TIME:**  
 **RUSH**  
      \_\_\_\_ day turnaround  
 **ROUTINE**

## Chain of Custody Record

Company: Rockwell Lime  
Address: 4110 Rockwood Road  
Manitowoc, WI 54220

Phone #: (\_\_\_\_) \_\_\_\_\_ - \_\_\_\_\_ Fax #: (\_\_\_\_) \_\_\_\_\_ - \_\_\_\_\_  
O. #: \_\_\_\_\_ Proj. #: \_\_\_\_\_ - \_\_\_\_\_  
Client Contact: Don Brisch  
Project ID / Location: Lime kiln exhaust

708-967-6666  
FAX: 708/957-6735

Due Date: \_\_\_\_\_ COC #: 31943

Sample Type:		Container Type:		Analyses	
1. Water	P - Plastic	2. Soil	G - Glass	3. Sludge	V - VOC
4. Oil	B - Bag	5. Tissue	O - Other	Other: <u>Air</u>	
Preservative:					
1. None	3. HNO <sub>3</sub>	2. H <sub>2</sub> SO <sub>4</sub>	4. NaOH		
Preservative	Lab I.D.	Method 5	Method 1	Method 2	Comments
70664	X				filter #5288
70663	X				" 5271
70664	X				" 5274
70665	X				
70666	X				
70667	X				
70668	X				
70669	X				
70670	X				
70671	X				
70672	X				

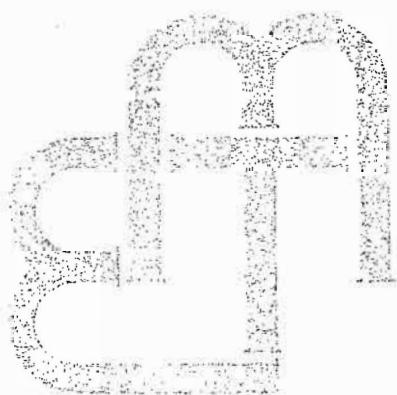
EMT REQUIRES PRIOR NOTICE OF SAMPLES CONTAINING CYANIDE. EMT SAMPLE RETURN POLICY ON BACK.

Inquainted By: <i>Jol Wojciech</i>	Date: 11-21-96 Time: 10:58 AM	Received By:	Date: -- -- Time: :	Witness:	<input type="checkbox"/> SAMPLE RECEIVED ON ICE
Inquainted By:	Date: -- -- Time: :	Received For Lab By: <i>U. Casy</i>	Date: 11-21-96 Time: 2:49		<input checked="" type="checkbox"/> TEMPERATURE ( )

**SPECIAL INSTRUCTIONS:**

## Appendix C

### **Calibration Data Gas Certification Sheets**



METER BOX CALIBRATION DATA  
ENVIRONMENTAL MONITORING AND TECHNOLOGIES INC.

DATE 6-24-96  
BAROMETRIC (Pb) 29.84 inHg      METER BOX NUMBER emt 001  
CALIBRATED BY ken

ORIFICE SETTING (DELTA H) in. H <sub>2</sub> O	TIME (MINUTES)	CAL METER (V <sub>c</sub> )	CAL METER AVERAGE TEMP.(°F) (T <sub>c</sub> )	DGM GAS VOLUME (V <sub>d</sub> )	DGM AVERAGE TEMP.(°F) (T <sub>d</sub> )	Y <sub>i</sub>	Δ H <sub>t</sub> (in. H <sub>2</sub> O)	CFM
---	-------------------	--------------------------------	--	--	--	----------------	--	-----

0.5	13.00	5.020	75.5	5.000	75.8	0.9937	1.871	0.385
1.0	9.00	5.020	76.0	5.000	77.8	0.9952	1.790	0.556
1.5	15.00	10.050	76.0	10.000	80.0	0.9991	1.853	0.667
2.0	13.00	10.020	76.0	10.000	83.8	1.0018	1.854	0.769
3.0	10.50	9.990	76.0	10.000	87.0	1.0022	1.815	0.952
4.0	9.00	9.950	76.0	10.010	89.0	0.9984	1.785	1.112

AVERAGE 0.9984	1.828
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Y FACTOR 0.9984
Δ H 1.828

POST-TEST METER BOX CALIBRATION DATA  
ENVIRONMENTAL MONITORING AND TECHNOLOGIES INC.

DATE	11-21-96	METER BOX NUMBER	EMT 001
BAROMETRIC (Pb)	30.20 inHg	CALIBRATED BY	Joe W.

ORIFICE SETTING (DELTA H) in. H20	TIME (MINUTES) (θ)	CAL METER GAS VOLUME (Vc)	CAL METER AVERAGE TEMP.(°F) (Tc)	DGM GAS VOLUME (Vd)	DGM AVERAGE TEMP.(°F) (Td)	Yi	
1.9		13.78	10.280	59.0	10.000	62.3	1.036
1.9		13.82	10.190	58.9	10.000	66.3	1.035
1.9		13.67	10.130	58.0	10.000	69.3	1.037

AVERAGE 1.0359

POST-TEST Y FACTOR 1.0359

METERBOX PRETEST Y FACTOR = 0.9984

PERCENT VARIATION =  $100 \% * ( \text{PRE} - \text{POST} ) / \text{PRE} = -3.8\%$

ALLOWABLE =  $\pm 5.0 \%$

ENVIRONMENTAL MONITORING AND TECHNOLOGIES INC:  
THERMOCOUPLE CALIBRATION DATA SHEET

DATE 10-14-96

OPERATOR Joe W.

THERMOCOUPLE # EMT 001

Temperature °F	Channel 1	DIFF.* %	Channel 2	DIFF.* %	Channel 3	DIFF.* %	Channel 4	DIFF.* %	Channel 5	DIFF.* %	Channel 6	DIFF.* %	Channel 7	DIFF.* %
0	0	0.0%	-1	-0.2%	-2	-0.4%	0	0.0%	1	0.2%	-1	-0.2%	-1	-0.2%
100	100	0.0%	99	-0.2%	98	-0.4%	100	0.0%	101	0.2%	99	-0.2%	99	-0.2%
200	201	0.2%	200	0.0%	199	-0.2%	201	0.2%	201	0.2%	199	-0.2%	200	0.0%
300	301	0.1%	299	-0.1%	298	-0.3%	300	0.0%	301	0.1%	299	-0.1%	300	0.0%
400	401	0.1%	399	-0.1%	398	-0.2%	400	0.0%	400	0.0%	399	-0.1%	399	-0.1%
500	501	0.1%	499	-0.1%	499	-0.1%	501	0.1%	501	0.1%	499	-0.1%	499	-0.1%
600	600	0.0%												
700	701	0.1%												
800	800	0.0%												
900	901	0.1%												
1000	1001	0.1%												
1100	1102	0.1%												
1200	1202	0.1%												
1300	1302	0.1%												
1400	1402	0.1%												
1500	1502	0.1%												
1600	1601	0.0%												
1700	1702	0.1%												
1800	1802	0.1%												
1900	1902	0.1%												

\* PERCENT DIFFERENCE =  $100\% * ((\text{Channel} + 460) - (\text{Temperature} + 460)) / (\text{Temperature} + 460)$

ALLOWABLE =  $\pm 1.5 \%$

**ENVIRONMENTAL MONITORING AND TECHNOLOGIES INC:**  
**THERMOCOUPLE CALIBRATION DATA SHEET**

DATE 11-21-96

OPERATOR Joe W.

THERMOCOUPLE # EMT 001

Temperature °F	Channel 1	DIFF.* %	Channel 2	DIFF.* %	Channel 3	DIFF.* %	Channel 4	DIFF.* %	Channel 5	DIFF.* %	Channel 6	DIFF.* %	Channel 7	DIFF.* %
0	0	0.0%	1	0.2%	1	0.2%	3	0.7%	2	0.4%	-1	-0.2%	-1	-0.2%
100	100	0.0%	101	0.2%	100	0.0%	102	0.4%	102	0.4%	99	-0.2%	99	-0.2%
200	201	0.2%	202	0.3%	201	0.2%	202	0.3%	202	0.3%	200	0.0%	200	0.0%
300	300	0.0%	301	0.1%	302	0.3%	302	0.3%	302	0.3%	299	-0.1%	299	-0.1%
400	400	0.0%	401	0.1%	402	0.2%	402	0.2%	401	0.1%	399	-0.1%	399	-0.1%
500	500	0.0%	501	0.1%	502	0.2%	502	0.2%	502	0.2%	499	-0.1%	499	-0.1%
600	600	0.0%												
700	700	0.0%												
800	800	0.0%												
900	900	0.0%												
1000	1001	0.1%												
1100														
1200														
1300														
1400														
1500														
1600														
1700														
1800														
1900														

\* PERCENT DIFFERENCE =  $100\% * ((\text{Channel}+460) - (\text{Temperature}+460)) / (\text{Temperature}+460)$

**ALLOWABLE =  $\pm 1.5 \%$**

## NOZZLE CALIBRATION.

### STAINLESS STEEL NOZZLES

SET A

NOZZLE #

Pre  
DIAMETER

ACTUAL DIAMETER

.368

.370

.365

1.103 / 3 .368

SET B

NOZZLE #

Post  
DIAMETER

ACTUAL DIAMETER

.368

.369

.368

1.105 / 3 .368

### PYREX NOZZLES

SET A

NOZZLE #

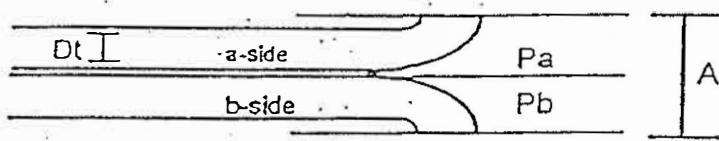
DIAMETER

ACTUAL DIAMETER

Environmental Monitoring and Technologies, Inc.  
Pitot Tube Inspection Data sheet

Probe/Pitot Number Pr 84 A

Date 10-19-96

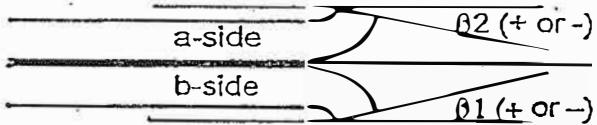
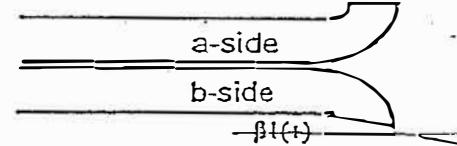
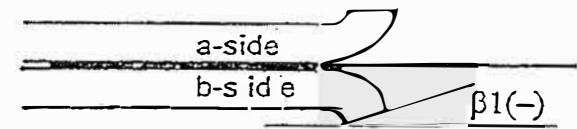
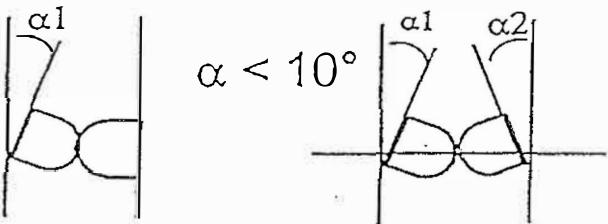


$$\frac{3}{16} < Dt < \frac{3}{8}$$

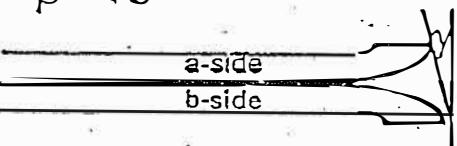
$$1.05 Dt < Pa < 1.50 Dt$$

$$1.05 Dt < Pb < 1.50 Dt$$

$$Pa = Pb$$

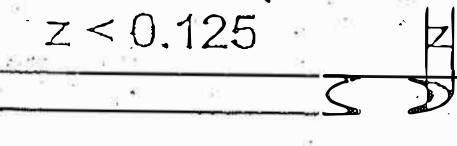


$$\beta < 5^\circ$$



$$z = A \cdot \sin \gamma$$

$$z < 0.125$$



$$w = A \sin \theta$$

$$w < 0.03125$$



Level ? Y

Obstructions ? N

Damaged ? N

$\alpha_1 (< 10^\circ)$  ✓

$\alpha_2 (< 10^\circ)$  ✓

$\beta_1 (< 5^\circ)$  ✓

$\beta_2 (< 5^\circ)$  ✓

$\gamma$   $\sim 5^\circ$

$\theta$  -

$A$  .936

$Dt$  368

$1.05Dt < Pa < 1.50Dt$  ✓

$1.05Dt < Pb < 1.50Dt$  ✓

$0.1875'' < Dt < 0.375''$  ✓

$A \sin \gamma < 0.125''$  ✓

$A \sin \theta < 0.03125''$  ✓

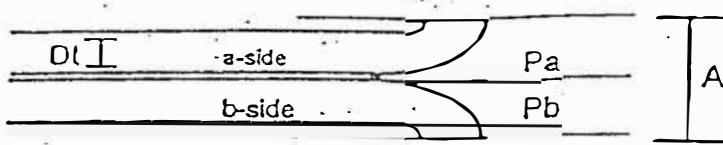
PASS INSPECTION? Yes

per method 2,  $C_p = 0.84$  ✓

# Pitot Tube Inspection Data sheet

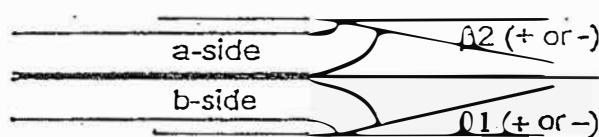
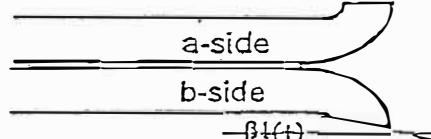
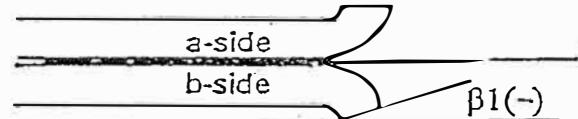
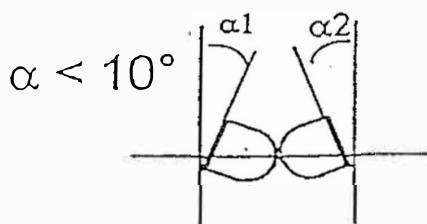
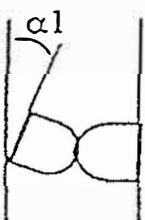
Probe/Pitot Number Pr 84 A

Date 11-21-96

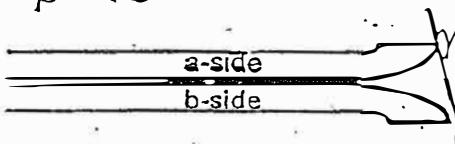


$$3/16 < D_t < 3/8$$

$$\begin{aligned} 1.05 D_t &< P_a < 1.50 D_t \\ 1.05 D_t &< P_b < 1.50 D_t \\ P_a &= P_b \end{aligned}$$



$$\beta < 5^\circ$$



$$z = A \sin \gamma$$

$$z < 0.125$$



$$w = A \sin \theta$$

$$w < 0.03125$$

Level ? Y

Obstructions ? N

Damaged ? N

$\alpha_1 (< 10^\circ)$  ✓

$\alpha_2 (< 10^\circ)$  ✓

$\beta_1 (< 5^\circ)$  ✓

$\beta_2 (< 5^\circ)$  ✓

$\gamma$   $\sim 5^\circ$

$\theta$  -

A 934

D<sub>t</sub> .368

$1.05 D_t < P_a < 1.50 D_t$  ✓

$1.05 D_t < P_b < 1.50 D_t$  ✓

$0.1875'' < D_t < 0.375''$  ✓

$A \sin \gamma < 0.125''$  ✓

$A \sin \theta < 0.03125''$  ✓

PASS INSPECTION? Yes

per method 2,  $C_p = 0.84$  ✓

EPA PROTOCOL GAS  
CERTIFICATE OF ANALYSIS

ORDER NO. 779768

CUSTOMER

BOC Gases Carol Stream  
640 Kimberly Drive  
Carol Stream, IL 60188

CYLINDER NO: CC14718  
EXPIRATION DATE: 06/05/98  
CERTIFICATION DATE: 06/05/96  
CYLINDER PRESSURE: 2000 psig

PURCHASE ORDER: 10151/EMT

COMPONENT	CERTIFIED CONCENTRATION	TOTAL RELATIVE UNCERTAINTY	CALIBRATION STANDARDS USED IN ASSAY			
			TYPE	LOT ID	CYLINDER	CONC.
Sulfur Dioxide	47.81 ppm		NTRM		CC-14410	44.2 ppm
Hydrogen	Balance Gas					7446-09-5 7727-37-9

ANALYZER READINGS

TEST NUMBER: 47927

SAY LABORATORY: Royal Oak

COMPONENT: Sulfur Dioxide

Analyzer: BOVAR Model 721-M NDUV S/N 93721M80647

Multipoint Calibration: 05/29/96

First Triad: 05/29/96 Analyst: Kathy Carroll Second Triad: 06/05/96 Analyst: Kathy Carroll

Ref	Ref	Sample	Zero	Ref	Sample
88.8		96.1	0	88.8	95.7
88.9		96	.3	88.8	96.1
88.9		96.1	.3	88.8	96

Mean First Assay: 47.82 ppm

Mean Second Assay: 47.80 ppm

Calibration Standard has been certified per the September, 1993 EPA Traceability Protocol, Document EPA-600/R93/224, using Procedure G1.  
This cylinder is certified to be +/- 1% NIST Traceable. Do not use this cylinder below 1.0 Megapascal, i.e., 150psig

QA APPROVED

A410

KCarroll

EPA PROTOCOL GAS  
CERTIFICATE OF ANALYSIS

ORDER NO. 809029

CUSTOMER

BOC GASES CAROL STREAM  
 640 KIMBERLY DRIVE  
 CAROL STREAM, IL 60188

CYLINDER NO: CC10433  
 EXPIRATION DATE: 10/14/98  
 CERTIFICATION DATE: 10/14/96  
 CYLINDER PRESSURE: 2000 psig

PURCHASE ORDER: ENVIRONMENTAL MONITOR

COMPONENT	CERTIFIED CONCENTRATION	TOTAL RELATIVE UNCERTAINTY	CALIBRATION STANDARDS USED IN ASSAY				
			TYPE	LOT ID	CYLINDER	CONC.	CAS NO.
Sulfur Dioxide	90.89 ppm		NTRM R81694	052494-07	CC-23854	91.1 ppm	7446-09-5
Nitrogen, O2 Free	Balance Gas						7727-37-9

ANALYZER READINGS

TEST NUMBER: 51241

ASSAY LABORATORY: Royal Oak

COMPONENT: Sulfur Dioxide

Analyzer: BOVAR Model 721-M NON-DISPERSIVE ULTRA VIOLET S/N 93721M80647

Last Multipoint Calibration: 09/30/96

First Triad: 10/07/96 Analyst: Kathy Carroll Second Triad: 10/14/96 Analyst: Kathy Carroll

Zero	Ref.	Sample	Zero	Ref.	Sample
0	91.4	91	0	91.5	91.4
0	91.3	91.1	0	91.5	91.4
0	91.4	91	0	91.5	91.4

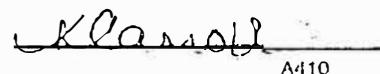
Mean First Assay: 90.77 ppm

Mean Second Assay: 91.00 ppm

This Calibration Standard has been certified per the September, 1993 EPA Traceability Protocol, Document EPA-600/R93/224, using Procedure G1.

Values certified to be +/- 1% NIST Traceable. Do not use this cylinder below 1.0 Megapascal, i.e., 150psig

QA APPROVED


 A handwritten signature in black ink, appearing to read "K. Carroll". Below the signature is the number "A410".